R29xx Digital Storage Oscilloscope

User's Manual

Multifunction 5 in 1

- Digital StorageOscilloscope

- Logic Analyzer

- FFT Spectrum

- Counter

- Clock Jitter Analyzer

Revision Ⅳ
Software Win98/me/2000/xp Version

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Table of Contents (R29xx Series)

Item Checklist **4**

Installing Hardware **4**

Installing R29xx Parallel Port Based Logic Analyzer 4
Installing R29xx W/USB 2.0 Adapter (USB 2.0 Adapter cover USB 1,1 version) 4

Installing Software **4**

Guide to Operations **5**

Hardware 5

Main Screen **6**

Introduction 6
Thumbnail 7
Ground Point Tick Marks 7
Trigger Level Tick Marks 7
Logic Analyzer Binary Data 7
Trigger Cursor 8
Horizontal V1Bar and V2Bar 8
Vertical Cursor A and Cursor B 8
Horizontal Scroll Bar 8
Vertical Scroll Bar 8
Multi-Window 9

Hardware Specifications **12**

Specifications 12

Clock Specification **15**

Internal 15
External 15
Analog to Digital Skew 15
Display 15

Calibration **15**

Probe Calibration 15

Programming Library **15**

File Menu Commands **16**

Load Data (File Menu) 16
Settings File Format 17
Data File Format 17
File Save (File menu) 17
Auto Save Settings Command (File Menu) 17
Print Setup Command (File Menu) 18
Exit Command (File Menu) 18

View Menu Commands 18

Tool Bar (View Menu) 18

Channel Display (View Menu) 19

Dots Connect (View Menu) 19

Dots 19
Lines and Dots 19

Persistence Mode (View Menu) 19

Timing Menu Commands 20

Backup Menu 21

Channel Dialog Box 21

Probe 22
Coupling 22
Volts/Division 22
Offset 23

FFT (Window Menu) 23

Measurements (Window Menu) 24
Parameter Measurements 25

Help Menu 25

Trigger Word (Setup Menu) 25

Accessories 26

Setting Up The Ttate Window 26

Electronic Counter 27

Clock Jitter Analyzer 28

X-Y Oscilloscope Plot Screen 30

Windows 98/ME USB driver install 31

Item Checklist

1) The R2902 (or R2904) Aluminum unit.
2) Logic Pod X 1. (each Logic Pod 8 channel, R2904 X 2 Pod)
3) Probe HP-9100 X 2. (R2904 X 4)
4) Color wires and Easy Hook clips X 10. (R2904 X 20)
5) D-Sub 25 PIN Cable 125 CM (Male ⇔ Female) X 1.
   [AWM style 2990 80℃ 30V VW-1 **IEEE 1284** compliant]
6) USB 2.0 Adapter with cable X 1.
7) DC Power Adapter **12V/1A (R2902**), or **12V/2A (R2904**) X 1.
8) R29xx User's Manual X 1.
9) CD for R29xx driver X 1.

Installing Hardware

Installing R29xx Parallel Port Based Logic Analyzer

1) Sets parallel port to EPP or BPP Mode (prefer to EPP)
2) Locate an available parallel port.
3) Connects included parallel port DB-25 cable to DSO.
4) Plug in power source from +12V/1A Adapter.
   (Note: R2902 use **12V/1A** Adapter, R2904 use **12V/2A** Adapter)
5) Waiting for control software turn on.

Installing R29xx W/USB 2.0 Adapter (USB 2.0 Adapter cover USB 1,1 version)

1) Turn off the computer and all peripheral connected. Remove the computer power cord from the wall outlet.
2) Locate an available USB interface (USB 2.0 Adapter cover USB 1.1 version)
3) Connect the included USB cable to USB interface.
4) Connect the other end of the USB cable to the USB Adapter.
5) Plug in power source from +12V Adapter.
6) Waiting for control software turn on.
7) After checking all connections, turn on the computer peripherals. you are now ready to install the software.

Note: The USB 2.0 Adapter support Windows 2000/XP version software.

Installing Software

1) Insert the distribution CD into drive E: ("E" is CD driver)
2) Select File menu.
3) Enter file to run E:\dso29xx\setup.exe.
4) Follow the on screen instructions.

Windows 2000 USB driver install 32

Windows XP USB driver install 36

Technical Support 39

Software Updates 39

APPENDIX 40

Fast Fourier Transformations 40

Understanding FFT's Application 40

Introduction to FFT 40

Typical FFT of Applications 40

Fundamental Principles 40

Magnitude 41

Decibel (db) 41

Logarithm 41

The Characteristics of Weight Function 42

Functionality 43

FFT 43

Bw.Sweep 43

Source 43

Points 43

Window 43

Gain Type 44

Certificate for R2902, R2904 44

Introduction 44

Offset and Amplify Calibration 45

Frequency Bandwidth 46

Trigger Position Calibration 46

Logic Analyzer Trigger Test 46

Guide to Operations

Hardware

When making measurements with the Digital Storage Oscilloscope / Logic Analyzer cards, meaningful data can only be captured with some prior knowledge of the characteristics of the circuit under test.
Before initiating any capture cycles, the DSO must be configured using the control program. see the software section later in the manual for instructions on these procedures.
To connect the DSO to the test circuit, there are two standard BNC probes, one for each Analog input channel, and a series of mini-clips on the Logic Analyzer Pod for the Logic input channels. The scope probes have removable hook clips on their ends and a attached alligator clip for the signal ground connection. The Logic Analyzer Pod has inputs for 16 channels, D0 channel is the external clock input, and 4 ground points. For synchronous data captures, external clock sources can be connected to the D0 channel.

At times, it may also be necessary to connect the test circuit to the computer system itself. This will eliminate more noise in the test application due to ground level differentials. This is especially true when dealing with high speed timing analysis. Use a heavy gauge wire to make a connection between the test circuit ground and the case of the computer. Each Analog channel probe has a calibration adjustment. It is important that this calibration be made at least twice a year. See Calibration for more information.

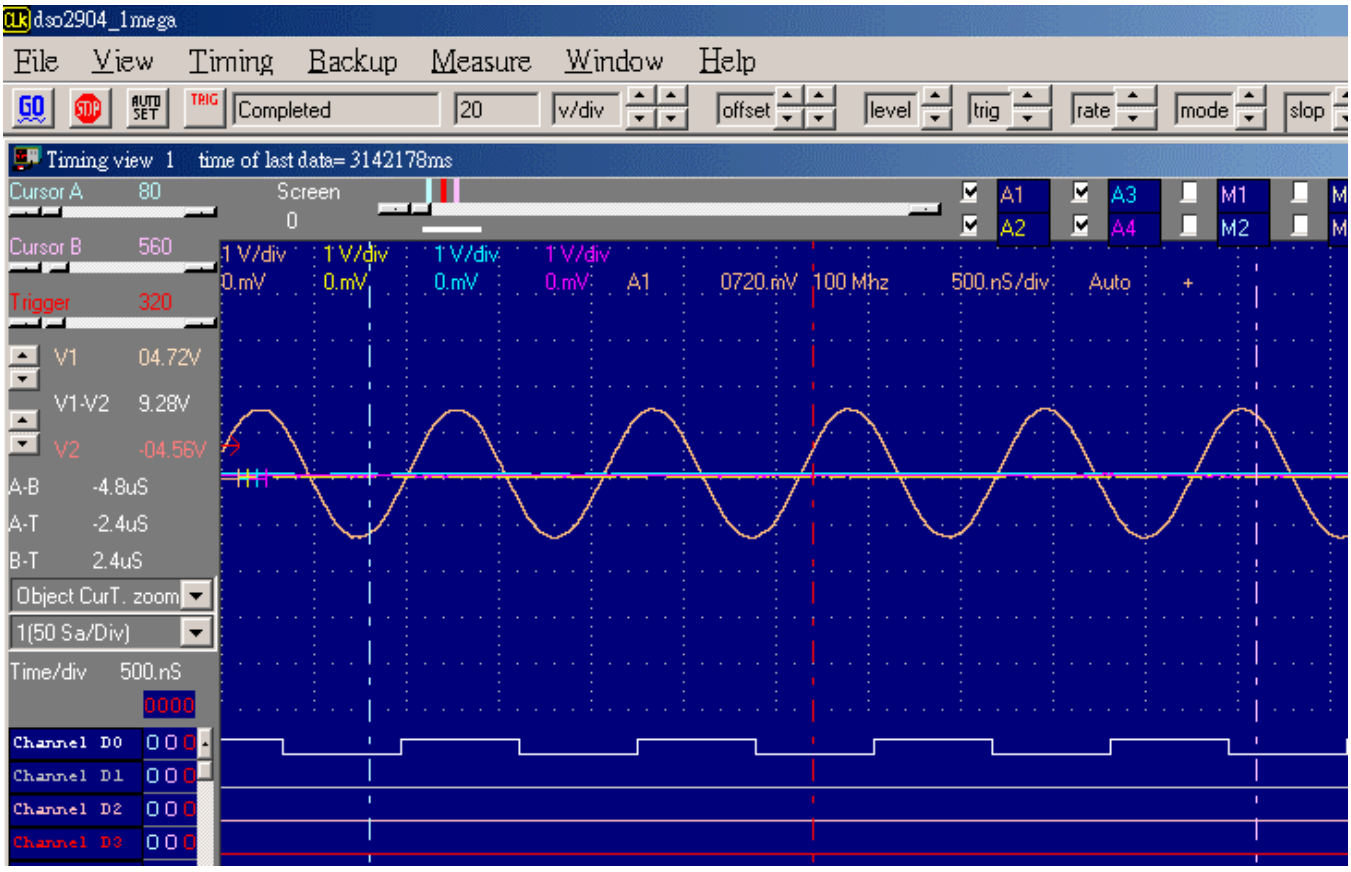
when connecting the probes to any signal, make sure that the signal voltage is within the limits of the DSO. Check the technical information section for absolute maximum and recommended maximum input voltages for the probes.

Logic Analyzer Pod Markings:

D0-D7 Channel	data inputs for dso2902.
D0-D15 Channel	data inputs for dso2904.
GND	Signal ground connection.

The wires and the clips that come with the pods are modular. The pods, wires, and clips can all be disconnected from each other by gently pulling them apart. Removing just the clips, but leaving the wires connected to the pods allows connections to be made to wires and posts of the test circuit of up to 0.64 mm (0.025 in).
Do not insert wires or posts greater than this diameter as that will expand the contacts in the wire beyond the allowed limit, possibly damaging the connector.

Main Screen



Introduction

The main display is made up of five areas. On the left side of the screen is the settings/parameter display. In the middle are the data displays. The top is the analog waveform display. The bottom is the logic analysis digital waveform display. Above the analog display is a "Thumbnail" graph representing the data buffer. This also shows the location of the cursors and which part of the buffer is being displayed.

On the upper left edge of the screen is the scroll selector area.

On the right side of the screen you will see the settings for one of the analog channels. you can select the active channel with the "select" button (next to channel name).

Just to the right of the analog waveform display are markers for the ground points. CH-A1 markings are closest to the display, than CH-A2. These "Tickmarks" will be displayed in the same color as the channel.

Just to the left of the analog waveform display are markers for trigger level settings. These "Tickmarks" will be displayed in the same color as the trigger cursor.

The lower left section of the screen contains the channel labels for the logic analyzer. These can be edited on screen by clicking on them or by selected edit channel names from the Channel/settings menu. The labels can be any alphanumeric string up to fourteen characters long. In the name edit window you can also change the order of the channels.

To select one of the cursors for scrolling click on its selection button or select it from the view menu.

Thumbnail

The "Thumbnail" Graph display represents the data buffer. The graph shows the locations of Cursor A Bar, Cursor B Bar, and the Trigger cursor, and also the current portion of the buffer displayed on the screen. Each item is displayed in its color. If Thumbnails are turned on a miniature waveform is displayed, otherwise a horizontal line is displayed for each channel.
The portion of the buffer being displayed in the DSO and Logic waveform windows is indicated by the grid colored box. This highlight changes size and position depending on the zoom setting and the displayed position.

Ground Point Tick Marks

Located to the right of the Analog Display. The Ground Point Tick Marks are `-|' shaped. These display the ground points of each analog channel. Ground Point Tick Marks associated with Channel A1 are leftmost and Channel A2 through A4 are successively further to the right. They are color coded the same as the data channels that they refer to. These Tick Marks can be moved by grabbing and dragging with a pointing device, or from the Channel dialog box.

Trigger Level Tick Marks

Located to the left of the Analog Display. The active Trigger Level(s) are displayed here with Level 1 displayed to the right of level 2. The Trigger Level Tick Mark is `->' shaped. They display the trigger levels and are color coded the same as the trigger cursor. These tick marks can be moved by grabbing and dragging with a pointing device, or by the trigger dialog box.

Logic Analyzer Binary Data

To the left of the Logic Display are the binary values of each logic input at the Vertical Cursor A and Vertical Cursor B positions. To the right of the Logic Display are the binary values of each logic input at the Trigger Cursor position.

Trigger Cursor

The Trigger Cursor is a vertical cursor that defines the actual trigger position within the data buffer of the trigger channel. Pre and post trigger information are directly related to the Trigger Cursor position.
The trigger cursor position can be changed by:
-Grabbing and dragging the Trigger Cursor with a pointing device
-Selecting the Trigger cursor by clicking on the Trigger button (in the Selection Buttons) and using the Horizontal Scrollbar

Horizontal V1Bar and V2Bar

The Horizontal Cursors provide an easy means of voltage measurements. For a selected channel, the voltage difference between the two cursors is shown in the Parameters Display area.

V1Bar and V2Bar can be moved by:
-Grabbing and dragging the cursors with a pointing device
-Selecting the Cursor by clicking on the V1Bar or V2Bar button and using the Vertical Scrollbar

Vertical Cursor A and Cursor B

The Vertical Cursors provide an easy means to make time measurements. For a selected channel, the time difference between the two VBar and the trigger cursor is shown in the Parameters Display area.

Cursor A and Cursor B can be moved by:
-Grabbing and dragging the cursor.
-Selecting the Cursor by clicking on the Cursor A or Cursor B button and using the Horizontal Scrollbar.
-Selecting the trigger cursor from the view menu.

Horizontal Scroll Bar

This scroll bar is used in conjunction with a selected waveform or cursor. The Horizontal Scroll Bar will move a selected waveform or cursor left or right in the display area.
The Horizontal Scroll Bar works with Display, Analog input channels, Memory, Logic Analyzer channels, Cursor A, Cursor B, and Trigger Cursor.

Vertical Scroll Bar

This scroll bar is used in conjunction with a selected waveform or cursor. The Vertical Scroll Bar will move a selected waveform or cursor up or down in the display area.
The Vertical Scroll Bar works with Display, Analog input channels, Memory, V1Bar, and V2Bar.

Channel display Select display Channel(A1,2,3,4 and M1,2,3,4).
Object point

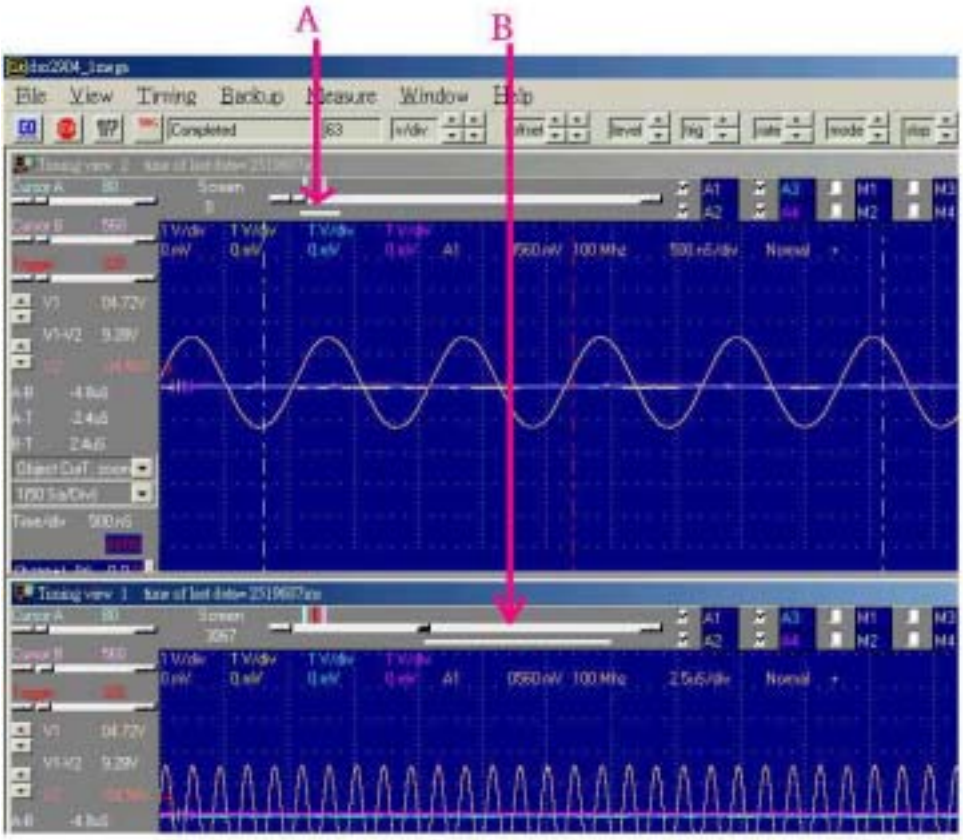
Set cursor Bar(V1, V2, Trigger, Screen (left or center) for zoom operate reference. Moves one or more cursors to the display area. These commands are also available by clicking on the toolbar.

Object is cursor A	Centers waveform display area around Cursor A.
Object is cursor B	Centers waveform display area around Cursor B.
Object is cursor trigger	Centers waveform display area around the Trigger Bar.
Object is cursor A1-4	Let v1 and v2 have reference object.

Multi-Window

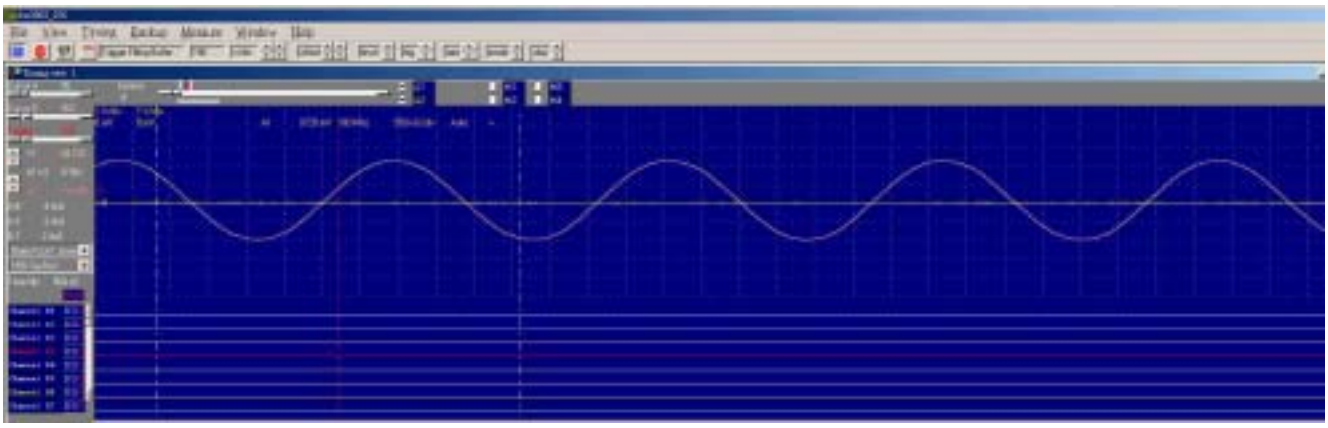
This software is a revolution software, it have a lot of new function, even tradition famous oscilloscope have not these powerful function.

this software show a lot of timing, let user easy to compare and analyzer timing, tradition software no matter it is stand alone or computer base oscilloscope only show one timing, these one timing software only analyzer one segment of buffer, unlike this software it can look buffer in beginning and buffer in middle and buffer in end at the same time. the following picture part A show it is locate at beginning and part B at middle of buffer at the same time, every individual timing also support their own cursor, voltage measurement, zoom factor…etc.

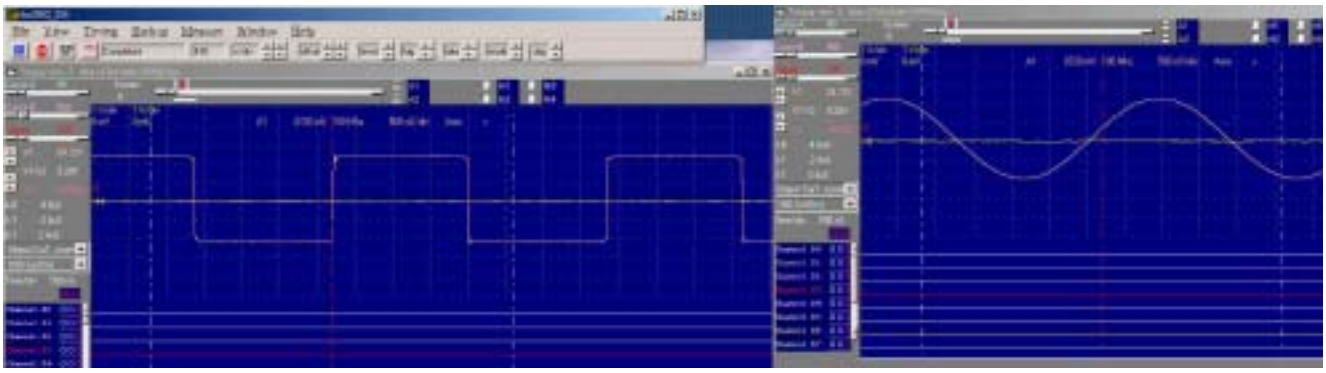


Another new function are let memory expand to 10 times by software, dso29xx now is 512K size, this software can let it look have 5.12 mega size when user open 10 timing and set 10 timing by auto function. the method is software.
continue capture data to these 10 timing, every timing have 512K individual buffer, so user can look almost 5.12 mega memory. it better than any famous oscilloscope in the world.

the third big function are it can show long timing when you have two monitor, the following show two monitor long timing, it can let user easy analyze timing, so stand alone oscilloscope can not do it, because they only have one monitor.



The fourth function is it can support two different timing at different monitor. the follow picture is left monitor show square waveform and right monitor show another waveform. it easy compare last capture data and current data at different monitor. these function even famous oscilloscope have not support it.



Hardware Specifications

Specifications

***The Model No: R2902/256K & R2904/256K are discontinue from September 2005.**

Model	*R2902/256K [250MHz]	*R2904/256K [250MHz]	Remark
Sampling Rate	1Sa/s to 250MSa/s by 1, 2, 5 sequence		Internal clock
External Clock	0 to 80 MHz, 200Kohm // 4pF, ± 50V Max.		From Channel D0
Record Length	1K/8K/128K/256K		Point
Analog Channel	A1, A2	A1, A2, A4, A4	2 Ch / 4 Ch
Input Bandwidth	DC- 80MHz		@BNC Connect
Input Impedance	1Mohm // 15pF		
Max. Input Voltage	50v (100v Transient)		
Sensitivity	10mv/div to 2v/div		@Probe 1:1
Trigger Level	Positive or Negative Slope adjustable level		10 Vertical Divisions
Repetitive Mode	Up to 20 GHz		
Spectrum FFT	80 MHz (Fast Fourier Transform)		
Electronics Counter	Max. 7 Digits Resolution		
X - Y Plot	Allow to graph one channel to another		
Math.	+,-		
Multi-Window	Yes		
Operate	Mouse		
Digital Channel	D0 – D7 (8ch)	D0 – D15 (16ch)	Logic Pod
Input Bandwidth	DC - 80MHz		
Input Impedance	200Kohm // 4pF		
Max. Input Voltage	50v (100v Transient)		
Threshold Voltage	-1v ~ +3v		by 50mv step
Trigger Qualify	0,1, X (don't care) settings for all digital channels		
Trigger Delay	16 Mega Length (32 Mega Length if 1 channel mode)		
Power Supply	DC/AC Adapter 12V/1A	DC/AC Adapter 12V/2A	
PC Interface	Parallel port / USB 1.1/2.0		EPP / BPP
Net Weigh	1.4 Kgs	2.0 Kgs	
Size	230mmx135mmx35mm		Aluminum Case
Accessories	Logic pod, Probe (1:1, 10:1) USB 2.0 Adapter with cable Parallel cable (IEEE1284) Color wires with clips, DC Adapter User's Manual, CD driver	Logic pod, Probe (1:1, 10:1) USB 2.0 Adapter with cable Parallel cable (IEEE1284) Color wires with clips, DC Adapter User's Manual, CD driver	

Model	R2902/512K [500MHz]	R2904/512K [500MHz]	Remark
Sampling Rate	All Channel 1 Sa/s to 250 Ms/s	All Channel 1 Sa/s to 250 Ms/s	Internal clock
	1 Channel 1 Sa/s to 500 MHz (200 MHz Logic Channel)	2 Channel 1 Sa/s to 500 MHz (200 MHz Logic Channel)	
External Clock	0 to 80 MHz, 200Kohm // 4pF, ± 50V Max.		From Channel D0
Record Length	1K/8K/128K/512K		Point
	1 Channel 1Mega		
Analog Channel	A1, A2	A1, A2, A4, A4	2 Ch / 4 Ch
Input Bandwidth	DC- 80MHz		@BNC Connect
	1 Channel DC – 90MHz		
Input Impedance	1Mohm // 15pF		
Max. Input Voltage	50v (100v Transient)		
Sensitivity	10mv/div to 2v/div		@Probe 1:1
Trigger Level	Positive or Negative Slope adjustable level		10 Vertical Divisions
Repetitive Mode	Up to 20 GHz		
Spectrum FFT	80 MHz (Fast Fourier Transform)		
Electronics Counter	Max. 7 Digits Resolution		
X - Y Plot	Allow to graph one channel to another		
Math.	+,-		
Multi-Window	Yes		
Operate	Mouse		
Digital Channel	D0 – D7 (8ch)	D0 – D15 (16ch)	Logic Pod
Input Bandwidth	DC - 80MHz		
Input Impedance	200Kohm // 4pF		
Max. Input Voltage	50v (100v Transient)		
Threshold Voltage	-1v ~ +3v		by 50mv step
Trigger Qualify	0,1, X (don't care) settings for all digital channels		
Trigger Delay	16 Mega Length (32 Mega Length if 1 channel mode)		
Power Supply	DC/AC Adapter 12V/1A	DC/AC Adapter 12V/2A	
PC Interface	Parallel port / USB 1.1/2.0		EPP / BPP
Net Weight	1.4 Kgs	2.0 Kgs	
Size	230mmx135mmx35mm		Aluminum Case
Accessories	Logic pod, Probe (1:1, 10:1) USB 2.0 Adapter with cable Parallel cable (IEEE1284) Color wires with clips, DC Adapter User's Manual, CD driver	Logic pod, Probe (1:1, 10:1) USB 2.0 Adapter with cable Parallel cable (IEEE1284) Color wires with clips, DC Adapter User's Manual, CD driver	

Model	R2902/1 Mega [500MHz] **	R2904/1 Mega [500MHz] **	Remark
Sampling Rate	All Channel 1 Sa/s to 250 Ms/s	All Channel 1 Sa/s to 250 Ms/s	Internal clock
	1 Channel 1 Sa/s to 500 MHz (200 MHz Logic Channel)	2 Channel 1 Sa/s to 500 MHz (200 MHz Logic Channel)	
External Clock	0 to 80 MHz, 200Kohm // 4pF, ± 50V Max.		From Channel D0
Record Length	1K/8K/128K/1 Mega		Point
	1 Channel 2Mega		
Analog Channel	A1, A2	A1, A2, A3, A4	2 Ch / 4 Ch
Input Bandwidth	DC- 80MHz		@BNC Connect
	1 Channel DC – 90MHz		
Input Impedance	1Mohm // 15pF		
Max. Input Voltage	50v (100v Transient)		
Sensitivity	10mv/div to 2v/div		@Probe 1:1
Trigger Level	Positive or Negative Slope adjustable level		10 Vertical Divisions
Repetitive Mode	Up to 20 GHz		
Spectrum FFT	80 MHz (Fast Fourier Transform)		
Electronics Counter	Max. 7 Digits Resolution		
X - Y Plot	Allow to graph one channel to another		
Math.	+,-		
Multi-Window	Yes		
Operate	Mouse		
Digital Channel	D0 – D7 (8ch)	D0 – D15 (16ch)	Logic Pod
Input Bandwidth	DC - 80MHz		
Input Impedance	200Kohm // 4pF		
Max. Input Voltage	50v (100v Transient)		
Threshold Voltage	-1v ~ +3v		by 50mv step
Trigger Qualify	0,1, X (don't care) settings for all digital channels		
Trigger Delay	16 Mega Length (32 Mega Length if 1 channel mode)		
Power Supply	DC/AC Adapter 12V/1A	DC/AC Adapter 12V/2A	
PC Interface	Parallel port / USB 1.1/2.0		EPP / BPP
Net Weight	1.4 Kgs	2.0 Kgs	
Size	230mmx135mmx35mm		Aluminum Case
Accessories	Logic pod, Probe (1:1, 10:1) USB 2.0 Adapter with cable Parallel cable (IEEE1284) Color wires with clips, DC Adapter User's Manual, CD driver	Logic pod, Probe (1:1, 10:1) USB 2.0 Adapter with cable Parallel cable (IEEE1284) Color wires with clips, DC Adapter User's Manual, CD driver	

**** DSO-2902, DSO-2904 Memory 512K and 1 Mega hardware upgrade to 500MHz, When purchase order from October 2005.**

Clock Specification

Internal

Sampling Rate: 1 Sa/s to 250 MSa/s or 500 Msa/s.
Time base: 4ns / Division to 20000s / Division displayable

External

Frequency: up to 80 MHz.
External Clock Delay: ~15ns.

Analog to Digital Skew

Analog channels are 5ns slower than Logic channels.
Setup/Hold Time : Internal Clock: 2/0 ns relative to clock edge.
External Clock: 2/0 ns relative to clock edge.

The memory mode will be displayed on the right side of the status bar.
Minimum required: a minimum of 128 Mbytes RAM is necessary to use the DSO control program.
256 Mbytes system RAM will be better.

Display

Magnification : from 1/200X to 1X to 50X
Cursors: There are two cursors. Cursor-A Cursor-B,V1 and V2 they are time and voltage Cursor1. They can be moved using the horizontal and vertical scroll bars or by grabbing and dragging them. Differences are automatically calculated and displayed on the screen.

Calibration

Probe Calibration

1) Connect the scope probe Ground Connection to the BNC GND.
2) Hold the probe's tip against the calibration point on the BNC center Hole.
3) A Square wave signal should appear on the screen.
4) Adjust the probe calibration until a true square wave is shown on the screen, noting the corners of the waveform which should be sharp and square, not rounded over or peaky.

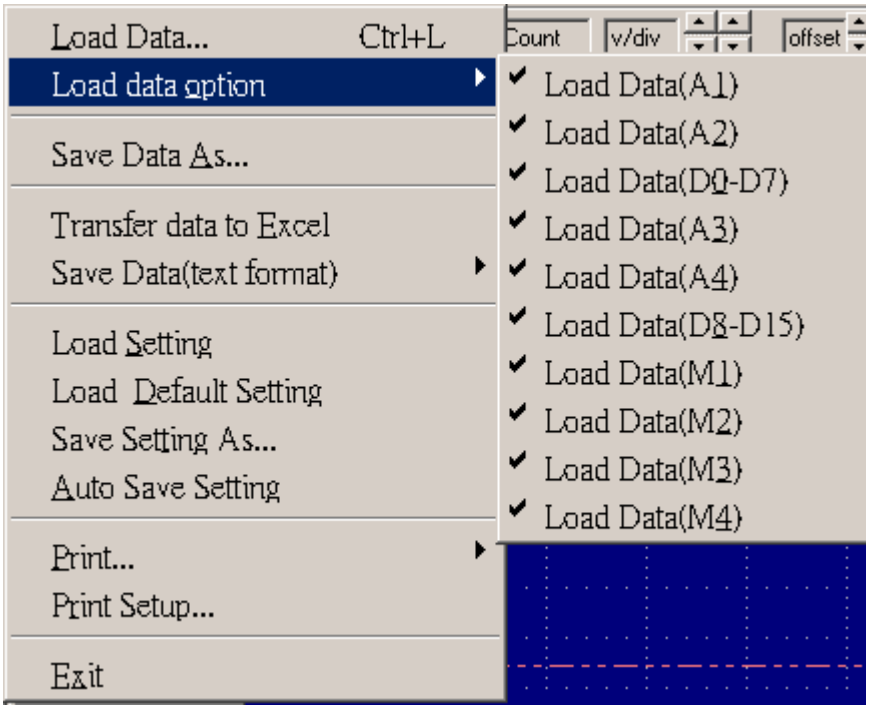
Programming Library

The VISUAL BASIC programming library is a source code level set of procedures that allow full control of the DSO-xxxx from your own programs. This is an optional package that is available from Clock Computer.

The package includes the source files for the library, example code for using the library.

The library consists of subroutines for full control of the DSO-xxxx. This includes routines to initialize the board, setup trigger conditions, setup acquisition parameters like sample clock rate and source, choose the gain and coupling settings, transfer data from the board to the PC, and save and load data to files.

File Menu Commands



The File menu offers the following:

Load data This option loads a full data file (.dso), with a setting file (.ini) together.

Load data option This option loads a data file (.dso), depend on the select of A1,2,3,4 or D0-D15.

Save data as This option saves a data file (.dso).

Load setting This option loads a previously `Save setting' setups.

Save setting This option saves the current settings to a file.

Load Default Setting Load default.ini to load parameters to factory defaults.

Auto save settings Auto load Dsoxx.ini setting file on program start run to set all configuration.

Print This option allows you to print the data.

Print Setup select Output style, printer and printer connection.

Exit Exit DSO software

Load Data (File Menu)

Specify which file to open in the file open dialog box:

File Name:
Type or select the filename you want to open. This box lists files with the extension you select in the List Files of Type box.
List Files of Type:
Select the type of file you want to open:
INI Settings File Format
DSO Data File Format
Drives
Select the drive in which to retrieve the file that you want to open.
Directories
Select the directory in which to retrieve the file that you want to open.

Click on OK when done, or Cancel to abort.

Settings File Format
The settings are now saved in an .INI file format and should be self explanatory.

Data File Format
data stored in binary format.

File Save (File menu)
The following options allow you to specify the name and location of the file you're about to save:

Type a new filename to save a document with a different name. A filename can contain up to eight characters and an extension of up to three characters. You must use one of the listed extensions to specify the type of file you wish to save.

Save File as Type
INI Settings File Format
DSO Data File Format

Drives
Select the drive in which you want to save the file.
Directories
Select the directory in which you want to save the file.

Click on the OK button when done, or Cancel to abort.

Auto Save Settings Command (File Menu)
Turns on or turns off the Auto save option. When this option is on, all settings will be loaded when start the program.

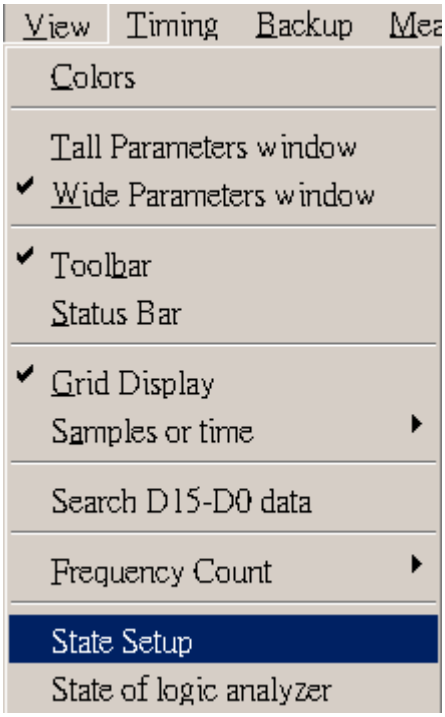
Print Setup Command (File Menu)

Print Setup dialog box allows you to configure the printer.

Exit Command (File Menu)

Use this command to end your session. You can also use the Close command on the application Control menu.

View Menu Commands



The View menu offers the following:

Color Change colors of the entire display.
The current colors are displayed on screen.
To change the color of an item select it from the pick list.
Then use the color palate to pick a new color.

Note: Items that are the same color as the background will not be visible.

Tall parameters window Show parameter in tall way.

Tall parameters window Show parameter in wide way.

Tool Bar Show or hide Tool Bar.

Status Bar Show or hide Status Bar.

Grid Show or hide grid on analog display.

Time or Samples For Timing display, display Time like as 12.34ms, or display how many samples.

Trigger word Set Trigger word for digital channel D0-D15.

Tool Bar (View Menu)

GO The Go command tells the DSO to start acquiring data when the trigger conditions are satisfied.
Pressed means Start capture, un-pressed means stop capture.

AUTO SET Automatic setup parameters for capture.

Channel Display (View Menu)

When Display is checked, the channel will be displayed on the screen.

When Display is not checked, the channel will not be displayed on the screen. Turning Display off for a channel will both speed up and un-clutter the display. However the data is still acquired from that channel unless transfer is turned off.

A channel's display can also be set with the buttons on the left edge of the screen. If the channel is on the button will be highlighted.

Note: This command applies to both analog and digital channels.

Dots Connect (View Menu)

Dots
Checking this option will display only the data points of the analog waveform. Logic data is unaffected by this option. This is the second fastest display option. Note that Lines will always be shown when in Sin (X)/X or Filter Interpolation modes.

Lines and Dots
Checking this option will display the lines connecting the data points and the data points of the analog waveform. Logic data is unaffected by this option. This is the slowest display option.

Note: The lines and dots can be set to different colors.

Persistence Mode (View Menu)

Turns on or turns off Persistence Mode. In this mode, with each acquisition of data, all previous waveform data remains on the display area. This mode is useful for finding waveform anomalies that occur infrequently. Persistence Mode is also useful for evaluating signal jitter.

Scroll, zoom, change display width, or any update of the screen will erase all of the old data and will initiate a new Persistence Mode capture.

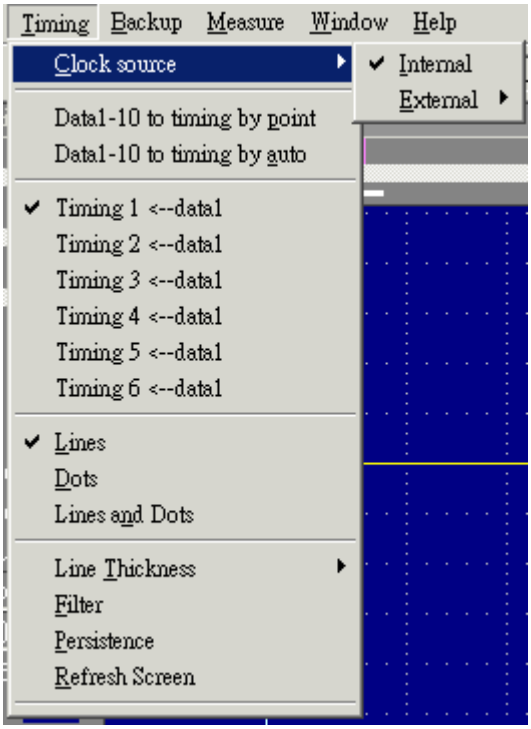
To turn Persistence On, select Persistence from the View Menu. To turn Persistence Off, select Persistence again from the View Menu.

All old data can be cleared, or erased from the display by selecting Refresh screen from the View menu, by clicking on the `refresh' button from the toolbar.

Note: scroll, zoom, change display width, or any update of the screen will erase all of the old data.

See also: View menu, Toolbar, clear button.

Timing Menu Commands



Clock source — Select internal clock or external clock (D0 channel), set rising or falling edge id set external clock.

Data1-10 to timing by point — User point which timing memory should be placed for captured data, it can let user captured 2 or 10 set different data to buffer and display, the sequence pointed by user, this function let user have 128k*10 or 256k*10 memory size.

Data1-10 to timing by auto — The same is true for it, it automatically capture 2 or 10 sets data to buffer, the sequence is 10,9,8,7,6,5,4,3,2 then 1.

Timing1-10<-data — Activate timing display. we suggest user use more than 1 screen to get better show.

Lines
Checking this option will display only the lines connecting the data points of the analog waveform. Logic data is unaffected by this option.

Dots
Checking this option will display only the data points of the analog waveform. Logic data is unaffected by this option.

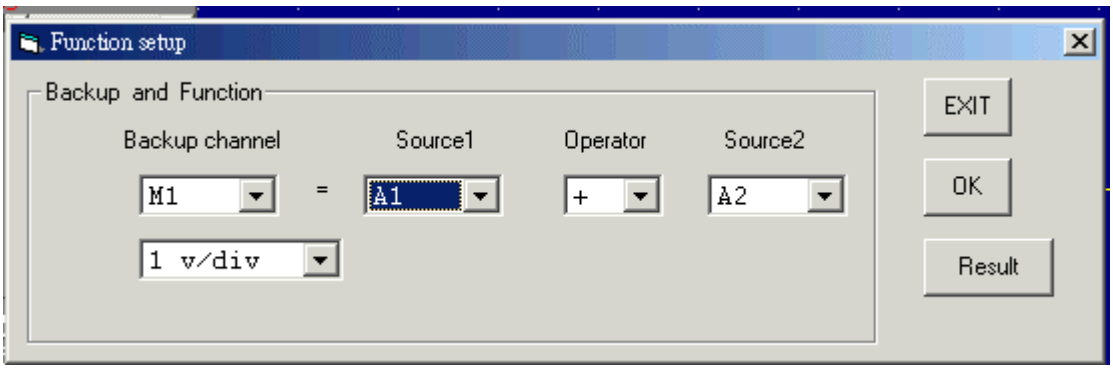
Lines and Dots
Checking this option will display the lines connecting the data points and the data points of the analog waveform. Logic data is unaffected by this option. This is the slowest display option.

Note: The lines and dots can be set to different colors.

Filter Filter is an averaging function and is defined as:
Display Point data1 =(data0+2*data1+data2) /4

Persistence Data from previous captures remains on screen and is overlaid by new data.
Refresh screen Clear/refresh the display (useful in persistence mode).

Backup Menu

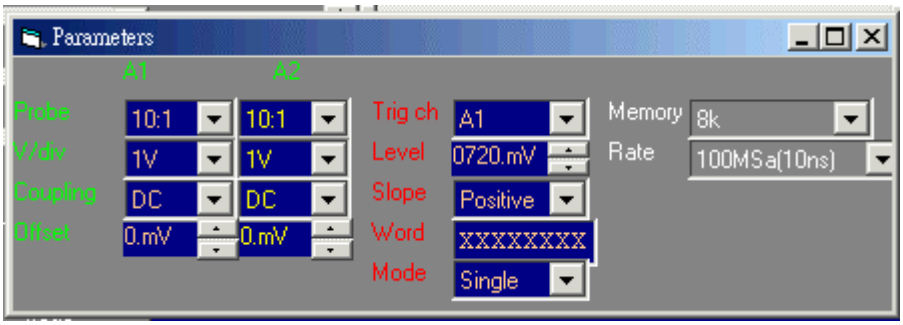


Backup Analog Channel A1,2,3,4 to M1,2,3,4 channel:
M1= A1 to A2 Store channel A1 with v/div plus channel A2 with v/div to M1(memory 1) for current timing view.

Channel Dialog Box

Show the Channel Dialog Box. All channel parameters are displayed in this box and can be

altered in it as well. You can bring up this dialog by clicking on the "view menu", select tall or wide window.
A different channel can be selected by hitting the "A1,A2,A3,A4" Ch Select button.



Probe

This controls the attenuation level for the probe inputs. This should be set to match the probe itself, either 1X, 10X, 100X or 1000X. When working with signal amplitudes within ?0 V, either the 1X or the 10X setting can be used. However, if the signal amplitude is outside of ?0 V, use the 10X setting. Note that using the 10X setting with both the probe and the scope even for signals within ?0 V will provide better frequency response through the system due to smaller voltage swings through to the digitizer.

Voltage range Probe and probe settings:

10mv/div to 2v/div @probe 1:1
100mv/div to 20v/div @probe 10:1
1000mv/div to 200v/div @probe 100:1
10v/div to 2000v/div @probe 1000:1

Coupling

The three selections available are AC, DC, and GND couple. Coupling can also be changed by Channel dialog box.
In the AC setting, the signal for the selected channel is coupled capacitively, effectively blocking the DC components of the input signal and filtering out frequencies below 10 Hz. The input impedance is 1MW || 5pF.
In the DC setting, all signal frequency components of the signal for the selected channel, are allowed to pass through. The input impedance is 1 MW || 5pF.
In the GND setting, both the input and the A/D converter are connected to ground. Again, the input impedance is 1 MW || 5pF. Use for setting the Ground reference point on the display or if calibrating the DSO board.

Volts/Division

V/Div controls the vertical sensitivity factor in Volts/Division for the selected analog channel. Each V/Div step follows in a 1-2-5 sequence. To get the best representation of the input signal, set V/Div such that the maximum amplitude swing is displayed on the screen. This will match the signal amplitude to use most of the digitizer's range, allowing the most bits to be

used.
Volts/division can be set via the V/div Combo to Settings.

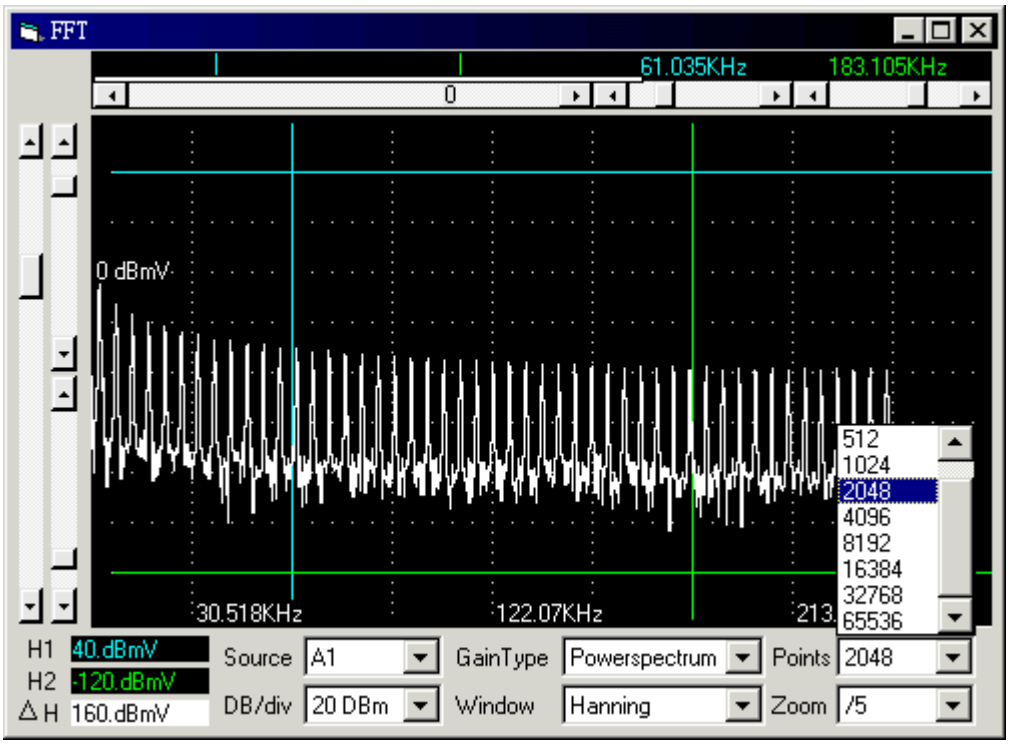
Volts/Division Probe can be set to
10mV, 20mV, 50mV, 100mV, 200mV, 500mV, 1V, 2V (1:1)
100mV, 200mV, 500mV, 1V, 2V, 5V, 10V, 20V (10:1)
1V, 2V, 5V, 10V, 20V, 50V, 100V, 200V (100:1)
10V, 20V, 50V, 100V, 200V, 500V, 1000V, 2000V (1000:1)

Offset

This parameter offsets the input signal in relation to the digitizer. This changes the usable input voltage range. The input voltage range is the offset +/- 5 divisions. Thus if you moved the offset to 1.00V with 1V /division the usable range would be 6.00V to -4.00V. Data outside the input range is clipped and stored as either the max or min input value. The offset references the 0.00V point (GND) for the input channel.

r button in the scroll bar. The offset can also be changed by grabbing and moving the appropriate Ground Point Tick Mark in the analog display area.

FFT (Window Menu)



The FFT window allows control and display of FFT's.

The following controls are available:
Window Select the FFT window type: (Triangular, Hanning, Hamming, Blackman-Harris, Rectangular, Wetch and Parzen).
Sample points Select how many points the FFT will sample, points can't exceed memory depth.
Horizontal zoom Select horizontal zoom ratio.

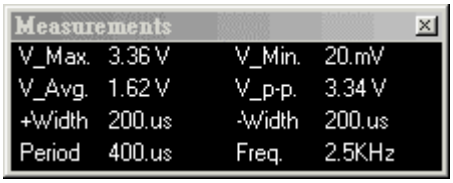
The FFT routines will process the selected channel starting at Cursor A and continue until "Sample Points" number of points has been reached. If Cursor A is not within the buffer, start of buffer will be used.

Waterfall display shows successive FFT breakdowns simultaneously on the screen offset from each other. This creates a waveform that shows the frequency behavior overtime. Up to 10 FFT breakdowns are shown at one time with the oldest furthest back. Typical uses include impulse response decay time in audio work.

To save FFT data go to File Save and choose a file type of "FFT".

Further information on FFT's can be found in the following sources:
Embedded Systems Programming magazine Volume 3, Number 5, May 1990
Embedded Systems Programming magazine Volume 7, Number 9, Sept 1994
Embedded Systems Programming magazine Volume 7, Number 10, Oct 1994
Embedded Systems Programming magazine Volume 8, Number 1, Jan 1995
Embedded Systems Programming magazine Volume 8, Number 2, Feb 1995
Embedded Systems Programming magazine Volume 8, Number 5, May 1995
Circuit Cellar Ink, The Computer Applications Journal Issue 52 Nov 1994
Circuit Cellar Ink, The Computer Applications Journal Issue 61 Aug 1995
Dr. Dobb's Journal Issue 227 Feb 1995

Measurements (Window Menu)



Automatic measurements on input waveforms can be performed. These include frequency, period, rise time, fall time, min, max, area,
Pulse parameter measurements are performed as specified by ANSI/IEEE std 181-1977 IEEE Standard on Pulse Measurement and Analysis by Objective Techniques.
Up to 10 signal parameters can be measured, tested, and displayed simultaneously.
To setup a measurement, select the **Measurements (Setup menu)** and choose one of the tests to setup (1 to 10)....

Parameter Measurements

area Sum of all voltages * sample time.
Cursor A (time) Position of Cursor A in time.
Cursor B (time) Position of Cursor B in time.
V1Bar (voltage) Position of V1Bar in voltage.
V2Bar (voltage) Position of V2Bar in voltage.
trigger cursor Position of trigger cursor in time.
A-B (time) Time difference between Cursor A and Cursor B.
V1-V2 (voltage) Voltage difference between V1Bar and V2Bar.
A-T (time) Time difference between Cursor A and trigger cursor.
B-T (time) Time difference between Cursor B and trigger cursor.
V_max. Maximum voltage.
V_min. Minimum voltage.
peak to peak The difference between maximum and minimum voltages.
Average Average of minimum and maximum voltages.
rms SQRT ((1/ # samples) * (sum ((each voltage) * (each voltage))))
rms (AC) SQRT((1/ # samples) * (sum ((each voltage - mean) * (each voltage - mean))))
period Average time for a full cycle for all full cycles in range.
duty cycle (rising) A ratio of width (rising) to period. starting with a positive edge using midpoint.
duty cycle (falling) A ratio of width (falling) to period. starting with a negative edge using midpoint.
risetime(10..90) Average time for a rising transition between the 10% to the 90% points.
risetime(20..80) Average time for a rising transition between the 20% to the 80% points.
falltime(10..90) Average time for a falling transition between the 10% to the 90% points.
falltime(20..80) Average time for a falling transition between the 20% to the 80% points.
pulse width (positive) Average width of positive pulses measured at 50% level.
pulse width (negative) Average width of negative pulses measured at 50% level.
Frequency Average frequency of waveform.

Help Menu

show our web site

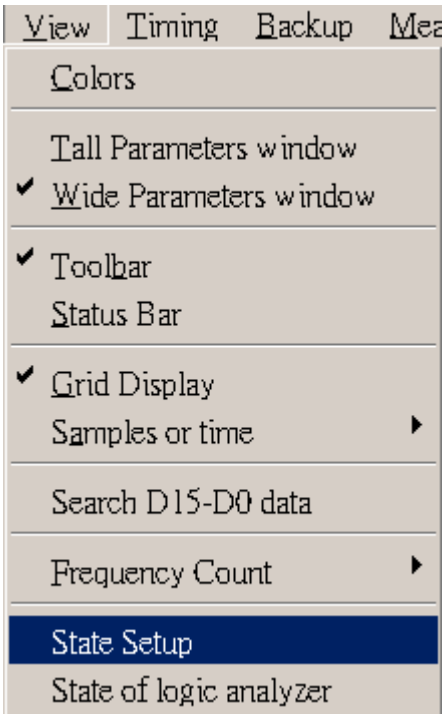
Trigger Word (Setup Menu)

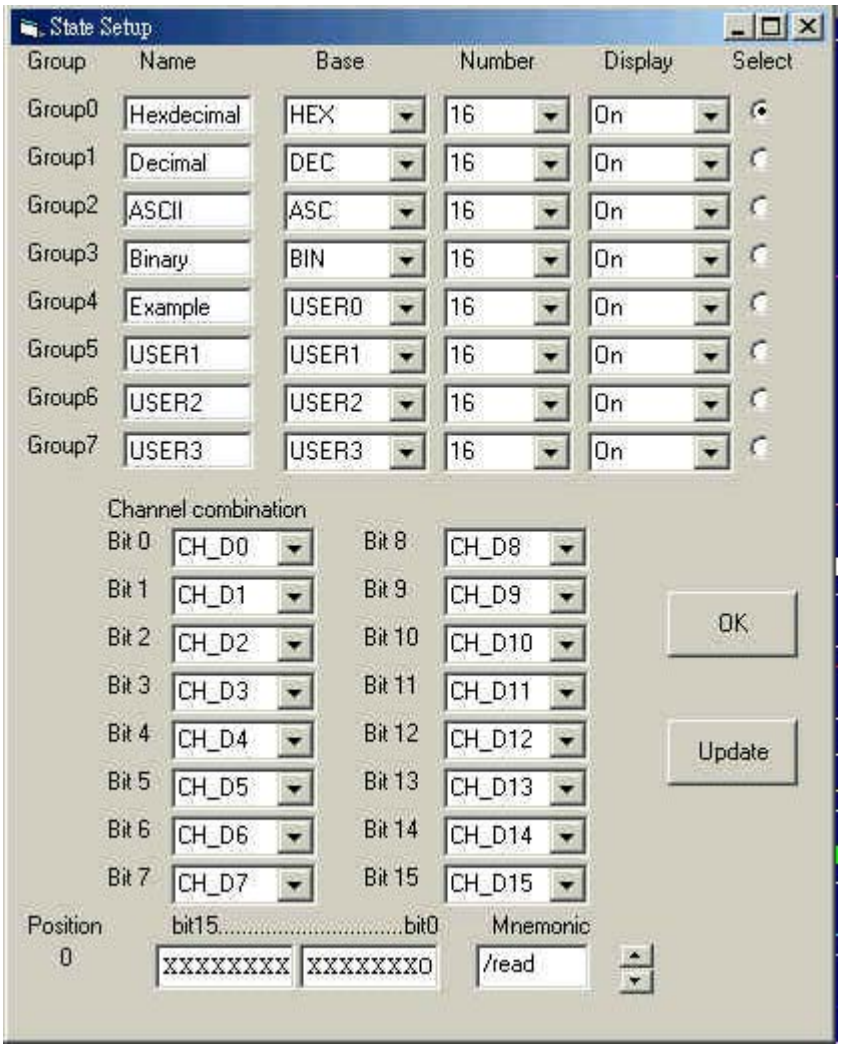
The Trigger word can set 0,1, and X (don’t care), example: 00xx1100
The right word is logic channel0,left word is logic channel 7.

Accessories

USB adapter
An optional USB 2.0 adapter is available for the R29xx series . It allows you to run the Digital Storage Oscilloscope from the USB port (both USB 1.1 & USB 2.0 version) of your computer instead of the Parallel Port interface.
Test Probe, Clips and Wires:
Extra Test Probe (x1, x10), clips and wires are available.
Dynamic Link Library [DLL]:
it is optional to order. It also include a visual basic demo source code software libraries are available to allow the user to write custom programs to control the instrument.

Setting Up The Ttate Window

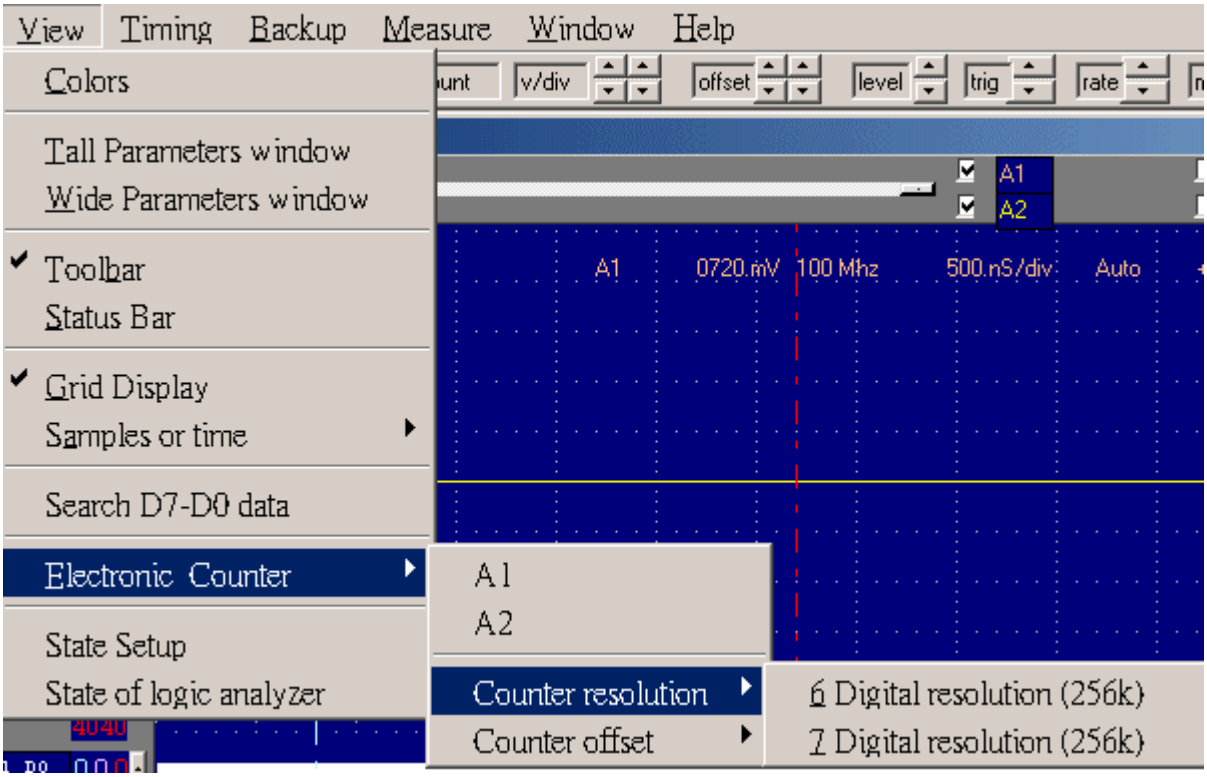


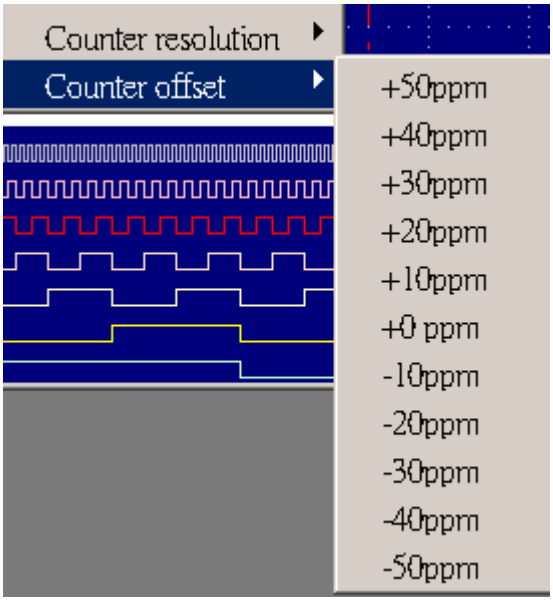


Setting up the state display.
1. Set group.
2. Select which group to display. Groups can be in different bases.
3. Set Base.
4. Set channel combination.

Electronic Counter

Dso29xx has built high accuracy oscillator 125.000000, 100.000000, 20.000000 MHz. (Dso-29xx_128k sample rate is PLL base, it will get worse accuracy. it is stop to sell now)
Dso-29xx support high accuracy and high resolution electronic counter base on oscillator inside.
It can reach 7 digits resolution by selecting large memory one of 256k,512k,1 mega.
It also has frequency calibration offset. user need use atomic clock to make sure you have a extra high accuracy clock to calibrate.



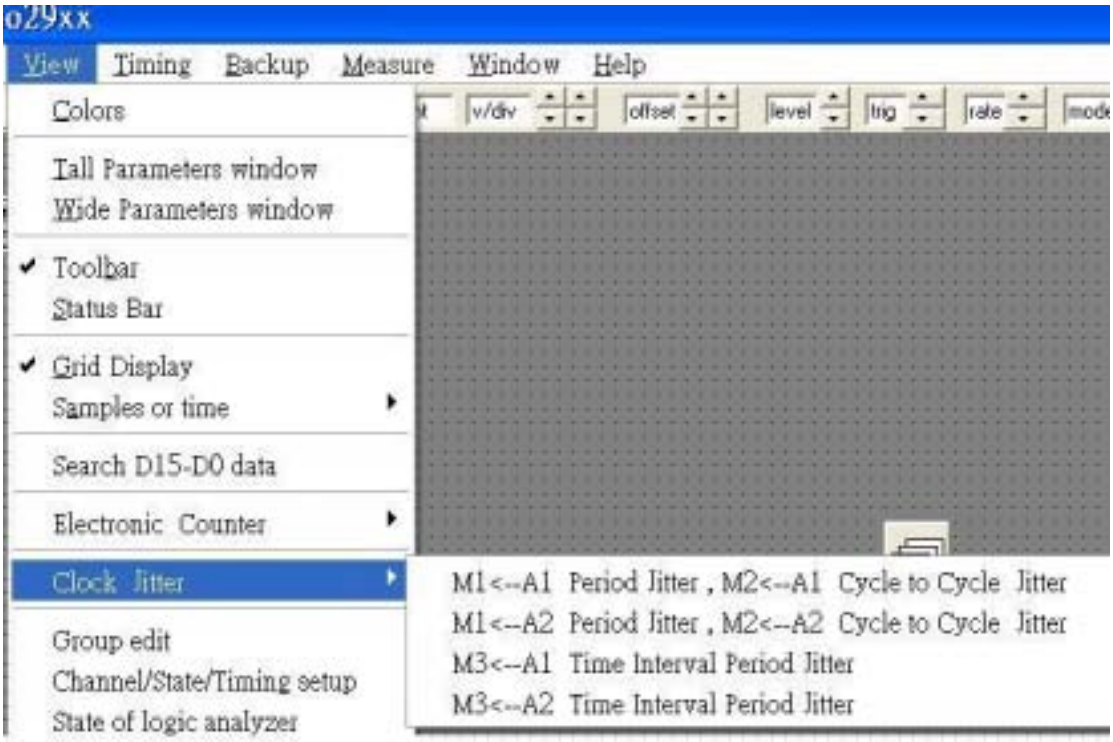


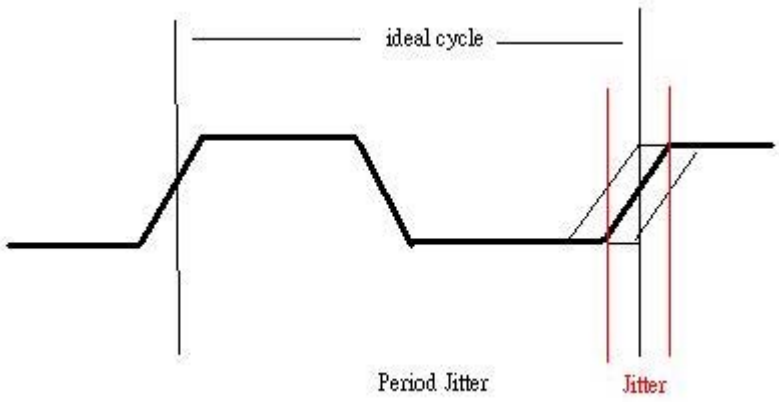
Clock Jitter Analyzer

R29xx has built in high accuracy oscillator 125.000000, 100.000000, 20.000000 MHz.
R29xx support high accuracy Clock Jitter Analyzer base on oscillator inside.

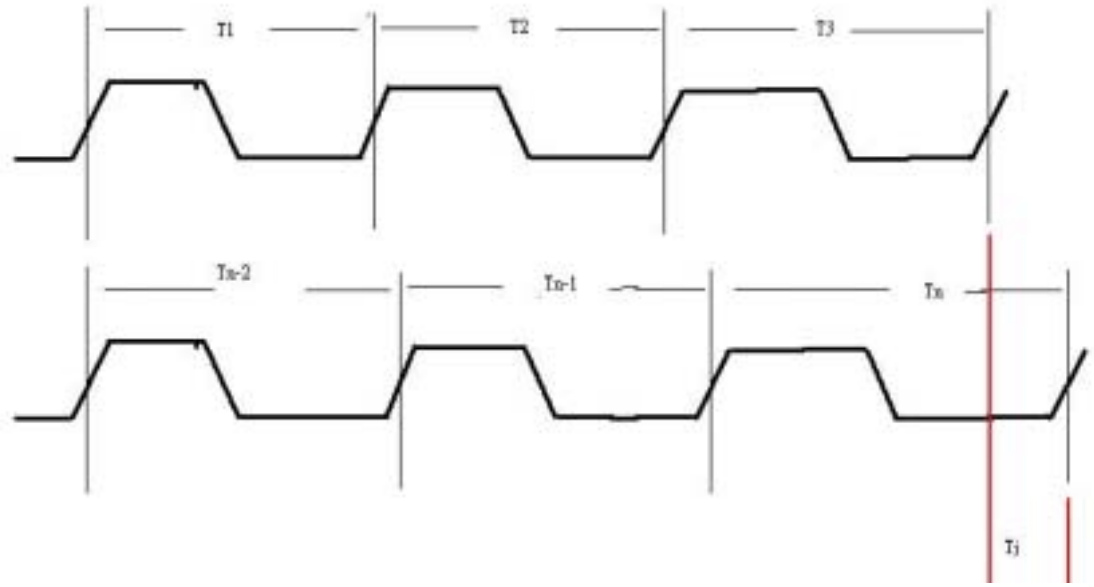
it has following function.

M1<--A1 Period Jitter , M2<--A1 Cycle to Cycle Jitter.
M1<--A2 Period Jitter , M2<--A2 Cycle to Cycle Jitter.
M3<--A1 Time Interval Period Jitter.
M3<--A2 Time Interval Period Jitter.



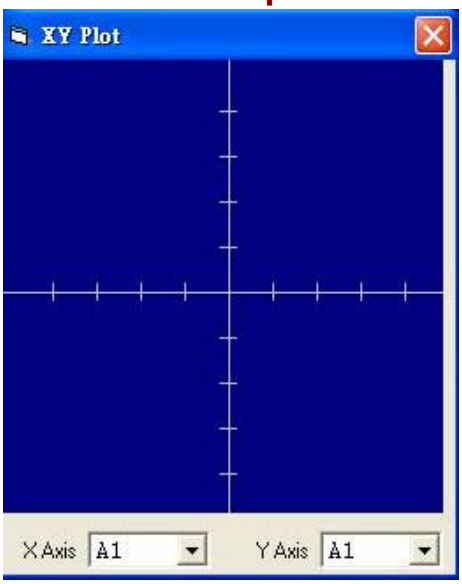


Period jitter is maximum change deviation in a clock transition from a ideal clock.
This software support two reference ideal clock.
One is user input interval period value (M3<--A1 Time Interval Period Jitter),
another is program automatic search all memory to get mean clock period
(M1<--A1 Period Jitter).
then put jitter to every clock cycle in backup memory.



cycle to cycle period jitter is the change in a clock transition from its corresponding position in the previous cycle.
cycle to cycle Jitter j1=t2-t1
cycle to cycle Jitter j2=t3-t2
Long term period jitter is the change in a clock transition from first clock to end of clock in memory
compare to ideal clock.
it can get Long term period jitter Tj from diagram after choose M3<--A1 Time Interval Period Jitter .
it also show the first and ending clock position.

X-Y Oscilloscope Plot Screen



An X-Y Plot allows you to graph one channel vs. another.

Windows 98/ME USB driver install

When USB2.0 control interface be connected to computer, screen will display as following:

Add New Hardware Wizard
Windows has found the following new hardware:
USB2.0 Device
Windows can automatically search for and install software that supports your hardware. If your hardware came with installation media, insert it now and click Next.
What would you like to do?
Automatic search for a better driver (Recommended)
Specify the location of the driver (Advanced)
< Back
Next >
Cancel

Click Next to continue

Add New Hardware Wizard
Windows will search for new drivers in its driver database on your hard drive, and in any of the following selected
Search for the best driver for your device. (Recommended).
Removable Media (Floppy, CD-ROM...)
Specify a location:
D:\dso25216\Usb20Driver
Browse
Display a list of all the drivers in a specific location, so you can select the driver you want.
< Back
Next >
Cancel

Edit or browse path to ...\USB20driver\win98_ME\gene.inf
(here D: is CD location, dso25216A may be dso29xx or la5000)
Click Next to continue

Add New Hardware Wizard
Windows driver file search for the device:
Usb2.0 Win98/ME 5
Windows is now ready to install the best driver for this device. Click Back to select a different driver, or click Next to continue.
Location of driver:
D:\DSO25216\USB20D~1\WIN98_ME\GE
< Back
Next >
Cancel

Click Next to continue

Completing install

Windows 2000 USB driver install

When USB2.0 control interface be connected to computer, screen will display as following:

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install a device driver for a hardware device.
To continue, click Next.
< Back
Next >
Cancel

Click Next to continue

Found New Hardware Wizard
Install Hardware Device Drivers
A device driver is a software program that enables a hardware device to work with an operating system.
This wizard will complete the installation for this device:
USB2.0 Device
A device driver is a software program that makes a hardware device work. Windows needs driver files for your new device. To locate driver files and complete the installation click Next.
What do you want the wizard to do?
Search for a suitable driver for my device (recommended)
Display a list of the known drivers for this device so that I can choose a specific driver
< Back
Next >
Cancel

Click Next to continue

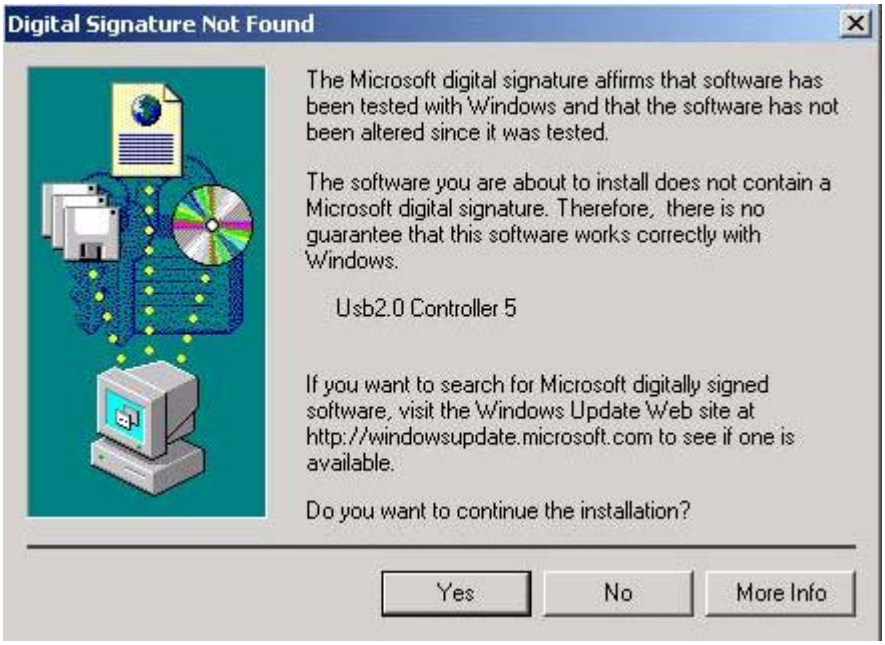
Found New Hardware Wizard
Locate Driver Files
Where do you want Windows to search for driver files?
Search for driver files for the following hardware device:
USB2.0 Device
The wizard searches for suitable drivers in its driver database on your computer and in any of the following optional search locations that you specify.
To start the search, click Next. If you are searching on a floppy disk or CD-ROM drive, insert the floppy disk or CD before clicking Next.
Optional search locations:
Floppy disk drives
CD-ROM drives
Specify a location
Microsoft Windows Update
< Back
Next >
Cancel

Click Next to continue

Edit or browse path to ...\USB20driver\win2000_XP\gene.inf
(here F: is CD location, dso25216A may be dso29xx or la5000)
Press OK

Upgrade Device Driver Wizard
Driver Files Search Results
The wizard has finished searching for driver files for your hardware device.
The wizard found a driver for the following device:
USB2.0 Device
Windows found a driver that is a closer match for this device than your current driver.
To install the driver Windows found, click Next.
f:\dso25216\usb20driver\win2000_xp\gene.inf
< Back
Next >
Cancel

Click Next to continue


Digital Signature Not Found
The Microsoft digital signature affirms that software has been tested with Windows and that the software has not been altered since it was tested.
The software you are about to install does not contain a Microsoft digital signature. Therefore, there is no guarantee that this software works correctly with Windows.
Usb2.0 Controller 5
If you want to search for Microsoft digitally signed software, visit the Windows Update Web site at http://windowsupdate.microsoft.com to see if one is available.
Do you want to continue the installation?
Yes
No
More Info

Click Yes to continue

Found New Hardware Wizard
Completing the Found New Hardware Wizard
Usb2.0 Controller 5
Windows has finished installing the software for this device.
To close this wizard, click Finish.
< Back
Finish
Cancel

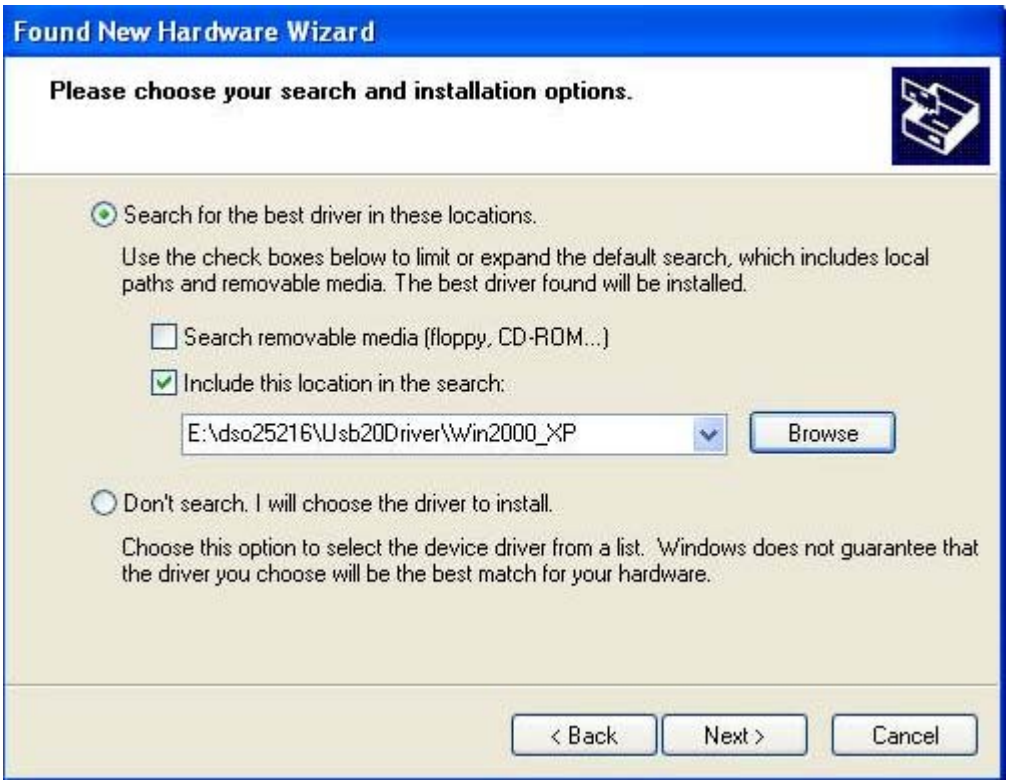
Completing install

Windows XP USB driver install

When USB2.0 control interface be connected to computer, screen will display as following:

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install software for:
USB2.0 Device
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

Click Next to continue


Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
E:\dso25216\Usb20Driver\Win2000_XP
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

Edit or browse path to ...\USB20driver\win2000_XP\gene.inf
(here E: is CD location, dso25216A may be dso29xx or la5000)
Click Next to continue

Found New Hardware Wizard
Please wait while the wizard installs the software...
Usb2.0 Controller 5
Hardware Installation
The software you are installing for this hardware:
Usb2.0 Controller 5
has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)
Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.
Continue Anyway
STOP Installation

Press Continue Anyway

Completing install

Technical Support

Technical support can be reached at

10 Electro Road, Toronto, ON, M1R 2A7, Canada
Phone: +1 (416) 7570764
Fax: +1 (416) 7570764
E-mail: Support@rorixwell.com

Software Updates

Software can be downloaded from our website
http://www.Rorixwell.com

10 Electro Road, Toronto, ON, M1R 2A7, Canada
Phone: +1 (416) 7570764
Fax: +1 (416) 7570764
E-mail: Support@rorixwell.com

APPENDIX

Fast Fourier Transformations

Understanding FFT's Application

Introduction to FFT

Detecting and measurement are the basic functions of signal processing. In some application, it is important to analyze the periodic components of sinusoidal signals. FFT can serve as a tool to dismember a signal into its periodic components for analysis purposes.

Typical FFT of Applications

1) Antenna's directional diagram is a function of Fourier's Transformation of transmitting current.
2) On the front and back focus planes of convex lens in an optical system, the amplitude distribution is a Fourier's Transformation.
3) In Probability, a power density spectrum is a Fourier's Transformation.
4) In Quantum Theory, the Momentum and Location of a particle are connected through Fourier' Transformation.
5) In Linear System, Fourier Transformation is the product of System Transmission Function times Input Signal Fourier Transformation.
6) The Noise Analysis of signal detecting can be obtained through Fourier Transformation. These are all different applications, but they share the same analytical path which is Fourier Transformation.

Fundamental Principles

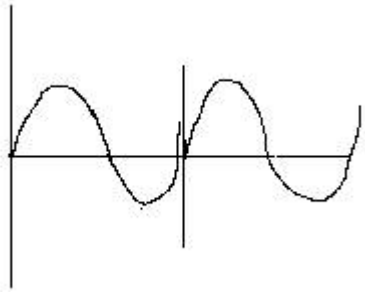
The Fourier Transformation Formula:

$$F(x) = (1 / M) \sum_{K=0}^{2M-1} Tk \{ \cos [2 \pi K (x / M)] + i \sin [2 \pi K (x / M)] \}$$

Tk : The mapping data value for the Time Domain.
F(x) : The mapping data value for the Frequency Domain.
M : FFT data length.
X : The mapping data value for the Frequency Domain.
i : Imaginary number.

The result of the formula is a vector of complex number. To show this on the screen, we present the Frequency as horizontal coordinate, we make the leftmost position representing zero frequency that is the direct current component. Harris had pointed out that due to periodic characteristics of FFT, we could observe the phenomena of discontinuation at the binderies of a finite length sequence. Therefore when we select randomly a signal sample, we could see points of discontinuation as a result of periodic expansion. This would produce leakage of

Frequency Spectrum across the whole frequency band. To suppress the amplitude of sample around the binderies, we must apply Weight Function to it.



discontinuation

The Vertical Axis on the screen is expressed in terms of Magnitude, Decibel (db) and Logarithm.

Magnitude

$$Mn = \sqrt{Rn^2 + In^2}$$

Decibel (db)

$$dbm\ Ps = 10 \log (Mn^2 / Mref^2)$$
$$20 \log (Mn / Mref)$$

Here Mref represents the reference value. It is define as 0 dbm or 0.316 V Peak-to-Peak Value or Effective Value 0.244V. It is define as 1.0 mW or it is defined as Resistance Value 50 Ω.

Logarithm

In this mode, the display is expressed in decibel and the Measurement is expressed in Magnitude.
Generally speaking, the Spectrum Processing System is expressed in the following formula:

$$Y(k) = \sum_{n=0}^{N-1} A(n) * X(k-n)$$

This formula utilizes Weighting function that is also known as Window.
For example, Hanning, Hamming, Blackman, Triangle and Rectangle.
These are further explained as following:

Hanning: It is cos α (θ) type window, expressed mathematically as following:

$$a(n) = 0.5 [\ 1-\cos (2 \pi n / N)\ ]$$

Hamming: It is similar to Hanning. The only difference is the coefficients for cosine term.

$$a(n) = 0.54 - 0.46 \cos (2 \pi n / N) , n = 0, 1, 2...., N-1$$

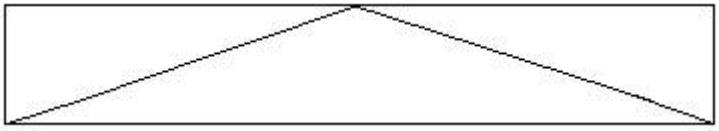
Blackman: It is the sum of a series of cosine terms. It is equal to Weighting function.

$$a(n) = \sum_{m=0}^{M} (-1) b(m) \cos (2 \pi nm / N) , n = 0, 1, 2...., N-1$$

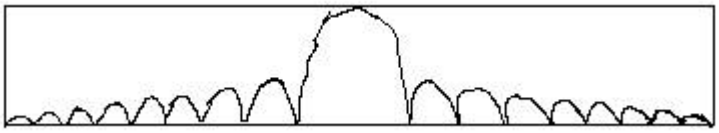
Triangle: Triangle Weighting Function, It is define as following:

$$a(n) = \begin{cases} 2n/N & n=0,1,2,..., N/2 \\ a(N-n) & n=(N/2)+1,..., N-1 \end{cases}$$

Rectangle: Rectangle Weighting Function



window coefficients



FFT. of window

Triangle Weighting Function

The Characteristics of Weight Function

Window	Highest Side Lobe	3db Bandwidth (bins)	5db Bandwidth (bins)	Scallop Loss (db)
Hanning	-35	1.54	2.14	1.26
Hamming	-43	1.30	1.81	1.78
Blackman	-61	1.56	2.19	1.27
Triangle	-27	1.28	1.78	1.82
Rectangle	-13	0.89	1.21	3.92

Functionality

The functionality of FFT can be achieved through the use of Utility. To use the Utility, We must set Channel/Math first, and then turn on FFT or Bw.sweep. We have to Bear that in mind that we could only analyze one channel at a time. After finish all the settings, we could see the screen showing FFT Channel.
We describe the differences between FFT and Bw,sweep as follow:

FFT

If we are using this mode, we are analyzing Channel A1 or Channel A2 in an Real Time Mode. To achieve the state of Synchronized Display. We are measuring time Domain while we are displaying Fourier Frequency Domain. In addition to that, we are able to analyze the stored signal easily. We only need to read the file on A1 Channel or A2 Channel, and then thrown on FFT. Whether we turn on Go or not is the difference in retreiving signals.

Bw.Sweep

When turning on this mode, we are analyzing A1 Channel or A2 Channel through the Frequency Sweep Mode to achieve the State of Frequency Output. The user must apply additional frequency to the point of measurement. Also we have to increase the frequency from small to large gradually. The finer the increment of frenquency, the better the obtained data will be. Attention must be made to clear the Frequency and record Sweep Frequency again every time when we turn on Go to retreive signal.

When a user set the Mode, he can also set the FFT parameters.
These are the required settings and they are explained as following:

Source

From channel A1, A2, M1 or M2.

Points

The points to be used are 256, 512, 1024, 2048, 4096, 8192, 16384 and 33678.
The user could think of these points as the scope of period. It can be understood that the more points we are taking, the better the results will be except the speed of it would be sacrificed. This is because the more you analyze the more time it takes to get the job done. It is an user's responsibility to make a judgment as to how a compromise should be achieved.

Window

The window is also known as (Weighting function), it includes Hanning (a fixed value, generally is peaking), Hamming, Blackman, Triangle and Rectangle. Please refer to the Fundamental Principle of this article. Due to periodic characteristics of FFT, we observe the discontinuation phenomena around the boundaries of the finite length sequence. We must use Window to suppress the amplitude of the sample around the boundaries.

Gain Type

The Vertical Axis on the screen is expressed in terms of magnitude, Power Spectrum and Logarithm.

1. Magnitude: The magnitude of the Polar Coordinates on the screen.
2. Logarithm: in this mode, it display Power spectrum and the measurement is expressed as Magnitude.
3. Power Spectrum: By formula Ps = 20 log (Mn/Mref).
Here Mref represents the Reference Value of 0.316V.
It is defined as 0 dbm.
0.316V p-p or 0.244V Effective Value also known as 1.0mW and the Resistance of 50 Ω.

The Vertical Axis on the screen is expressed in terms of Magnitude, db or Logarithm. These are explained as following:

DB/div: It is active only when Gain Type is set to Power spectrum. It is the unit of the Vertical coordinate. It represents DBm.
There are four different scales: 5, 10, 20, 50 DBm.
DB/offset: It is active only when Gain Type is set to Power spectrum. It can change the position of FFT to make it going up and down.

To obtain the measured data, using Ctrl and Alt keys plus Left or Right key to measure Frequency. To measure Magnitude, we can use Ctrl or Alt key plus Up or Down key. After that we can get the data displayed in the rectangle frame of FFT parameter.

Notes:
It is highly desirable to confirm the following items before doing analyzing:

1) If the measurement is for low frequency, we ought to make sure the frequency of the sample is not too large. Since the larger the frequency of the sample the large the Band Width. The sample frequency needs to be as twice as large as the frequency to be measured.
2) It is undersirable to use Logic Analyzer and FFT simultaneously.
3) It is desireable to have waveform on the Time Domain. The stronger the waveform the better the accuracy of the results.
4) To obtain the highest speed on FFT, we could turn all the channels off except for FFT.
5) The values of Depth can be 4K, 64K. When using 4K, we are using the real part and Imaginary part of the integer results of the Simulater Output for independent Probability Noise Signal. The MSE calculation results is obtained using 16 bits FFT processor with db less than 75 DB. If using db value greater than 75 DB, we are going to get too great an inaccuracy. When we are using 64K Depth, we are doing floating point calculation therefore the machine we use must have floating point math coprocessor.

Certificate for R2902, R2904

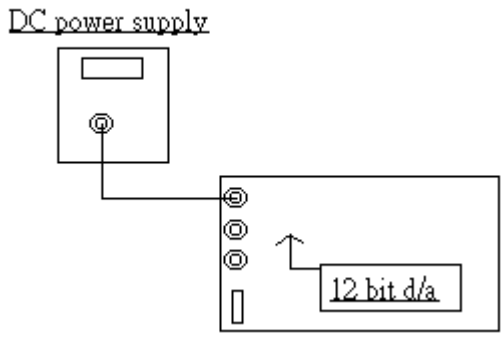
Introduction

Calibration equipment used

HP 33120A Serial No: US36034172

HP 8648A Signal Generator Serial No:3625U00521

This oscilloscope of DSO-29xx has built in automatic calibration system include hardware and software. in theory, user don't need use any instrument to adjust and calibration even after long term period using. the following is the compare diagram between tradition calibration and automatically calibration:

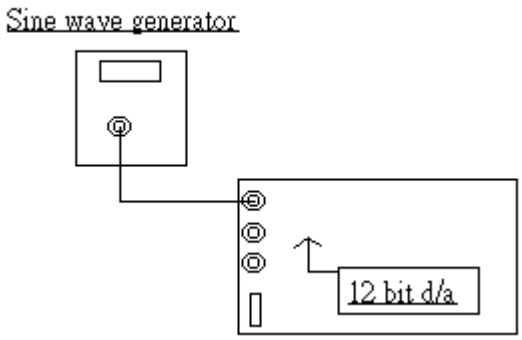


Offset and Amplify Calibration

The tradition calibration for vertical offset and amplifier use a vertical source as oscilloscope input source. R29xx use a high accuracy 12 bit d/a converter to instead it when every time push 'GO' button to capture data in first time and change rate every time. Set dc power supply to ground as oscilloscope input to test vertical offset or we call it vertical position for some other oscilloscope. our R29xx has a relay short to ground then capture data. it will use 12 bit d/a converter to adjust the level until R29xx can capture ground level at proper position. the same is true for amplifier adjust. Hardware and software should work on it to make sure the amplify has enough accuracy. the following is one test result:

	Scale	Input	Result	Input	Result
Cha1	10 mv/div	-40 mv	-40.4 mv	40 mv	39.2 mv
Cha1	20 mv/div	-80 mv	-80.8 mv	80 mv	78.3 mv
Cha1	50 mv/div	-200 mv	-201 mv	200 mv	202 mv
Cha1	100 mv/div	-400 mv	-400.8 mv	400 mv	400 mv
Cha1	200 mv/div	-800 mv	-802 mv	800 mv	785 mv
Cha1	500 mv/div	-2000 mv	-2017 mv	2000 mv	2004 mv
Cha1	1 v/div	-4 v	-4.05 v	4 v	3.96 v

Frequency Bandwidth

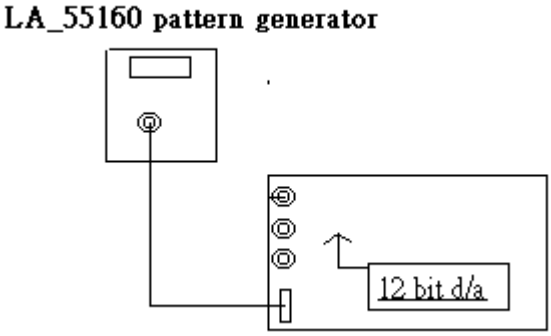


Let sine wave generator output peak to peak 600mv from 1 hz to 80Mhz. Set R29xx proper sample rate and scale. The result for R29xx should be in peak to peak 598mv to 602mv.

Trigger Position Calibration

R29xx use software let trigger position always lock in 100% accuracy position, even you zoom in the waveform, still lock in 100 % accuracy position.

Logic Analyzer Trigger Test



Use LA-55160 arbitrary pattern generator to output some specific word like 01010101 or 00001111 ... etc.
then set trigger word it should get trigger word at proper position.